

Pharmacy Data in the VA Health Care System

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Recent advances in Department of Veterans Affairs (VA) health care data systems have greatly increased access to operational pharmacy information. This article presents a brief guide to VA pharmacy data sources: the Veterans Health Information Systems and Technology Architecture files, the Pharmacy Benefits Management database, Decision Support System (DSS) National Data Extracts for inpatient and outpatient care, the planned DSS National Pharmacy Extract, DSS databases at local VA facilities, and the Non-VA Fee Basis files. Depending on the source, available data elements include patient demographics, clinical care information, characteristics of the medication and of the prescribing physician, and cost. Access policies are detailed for VA and non-VA researchers. Linking these sources to VA databases containing data on inpatient and outpatient services offers a comprehensive view of health care within several VA populations of general interest, including people over age 65 and those with physical and psychiatric disabilities.

Keywords: *pharmacy; medicine; cost; economics; micro-costing*

Continuing advances in health data systems within the Department of Veterans Affairs (VA) offer a new opportunity to study health care use among adults. VA databases of inpatient and outpatient health care utilization have existed for many years, and their utility for research has been documented elsewhere (Murphy et al. 2002). Only recently, however, has it been possible to link pharmacy data to VA patient-level utilization data. This article presents a brief guide to four sources of VA pharmacy data stored in electronic formats. It describes the contents and use of the data sources, noting strengths and limitations of each for research. We discuss access policies and offer guidance on selecting data sources based on the research questions proposed.

The VA patient population is of considerable interest due to its large size and nationwide representation. Vulnerable populations, such as people with low incomes, disabilities, or mental health and substance abuse problems, are present in substantial numbers. Although many VA patients are elderly men, the numbers of younger veterans and women allow for analysis of these groups as well.

The data sources we describe represent an important resource for health services research. Rising health spending is often linked to steady increases in the use of outpatient prescription drugs. There are several large non-VA prescription databases with information on privately insured individuals, but they have relatively few people over age 65. That population is growing, however, and its use of prescription medications is rising briskly (Parks Thomas, Ritter, and Wallack 2001). VA data are an important resource for understanding patterns and costs of pharmacy use by a large, predominantly elderly population.

Cost-effectiveness studies and related research are often performed using VA pharmacy data, but the advent of improved pharmacy data systems in recent years has opened up additional avenues of research. Risk-adjustment mechanisms based entirely on pharmacy claims have been developed for several populations (Gilmer et al. 2001; Lamers 1999; Fishman and Shay 1999; Fishman et al. 2003). Pharmacy data have been used to assess adherence to clinical practice guidelines by providers (Pillans et al. 2000; Fortney et al. 2001) and by patients (Melfi et al. 1998; Hoffman et al. 2003). They also represent an

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important means by which to measure the impact of uninsured status on health care (Schoen et al. 2001; Smith et al. 2001). All of these issues, and many others, can be addressed using VA pharmacy data, either alone or in combination with other sources.

We will begin with the pharmacy ordering process, describing its data elements and the interaction of provider and pharmacist. We then describe the larger clinical data system surrounding the pharmacy order process. Although that system can be accessed directly, most researchers instead draw pharmacy data from secondary sources. The remainder of the article describes three of these and notes additional minor sources. We provide side-by-side comparisons of the structure and contents of the major data sources in table format.

NEW CONTRIBUTION

To our knowledge, this is the first published resource describing the contents of multiple VA pharmacy data sources, which are unknown to many researchers. VA pharmacy databases are comprehensive, recording all aspects of prescription drug therapy across inpatient and outpatient settings. Medical supplies and other related products dispensed by VA pharmacies are included. VA costing methods allow for a comprehensive review of direct and indirect costs. A unique feature of the VA system is the existence of several pharmacy data sources, enabling researchers to view the data from a number of administrative and health services perspectives.

PRESCRIPTION ORDERING

VA stores patient medical records in electronic format. The records are accessed through the Computerized Patient Record Systems (CPRS). CPRS is one component of the larger clinical and management information system known as the Veterans Health Information Systems and Technology Architecture (VISTA). Providers use CPRS to review and update patient medical records and to place orders for medications, procedures, and tests (Veterans Health Administration 2003). Many data files and applications within VISTA support CPRS and its graphical user interface (CPRS-GUI).

Providers with authorization to make orders are given access to the CPRS pharmacy order screen. In the outpatient setting, after logging into CPRS-GUI, the provider selects the Add Orders Menu to order lab tests, radiological tests, medications, medical supplies, and other items. If the outpatient medication menu is selected, the medication order box appears. The provider

selects a pharmacy orderable item from the alphabetical list of generic and branded products (e.g., METOPROLOL TARTRATE TAB) in the medication order box. When a particular item is selected, the order dialog screen appears. It lists the available dosages (e.g., 12.5 mg, 25 mg, 50 mg, 100 mg, and 200 mg). The price per dispensed unit corresponding to each dosage will appear along with the associated route of administration, or method of consumption. Routes of administration include intravenous (IV), oral (PO/ORAL), and many others. Only the route that applies to a specific dosage form will appear when the product is selected. If a tablet is chosen, for example, only PO/ORAL will appear. After choosing the dosage and route, the provider specifies the schedule of administration. The schedule is the frequency of consumption, such as twice per day (BID) or three times per day (TID). The provider can also enter additional instructions for the pharmacist or patient in a free-text field. These comments appear with the dosing instructions.

Depending on the product selected, the CPRS-GUI may flash messages associated with the product. The messages may suggest specific days supplied, provide information about product restrictions, or give information regarding policy or pricing. A message about days supplied might encourage the provider to choose particular values. If there is no such message, then he or she must specify the number of days supplied and the number of refills deemed appropriate. VA pharmacies customarily fill either 30- or 90-day supplies of routine medications. The total quantity dispensed (e.g., tablets, vials) is automatically calculated by VISTA based on the dosage, schedule, and days supplied selected, although it may be altered manually by the provider. The provider then specifies the pickup method of the prescription; options include mail-order, the medical center pharmacy, and in-clinic (e.g., for vaccinations). Finally, the priority of the prescription is specified as routine, urgent, or immediate.

The dosing instructions field is automatically generated based on product information in VISTA files and order elements selected by the provider. The order software calculates the quantity to be consumed at each dose based on the chosen values of strength, dosage, and schedule. It then attaches any free-text comment the provider has made. The result is a statement in plain English. For example, an order for METOPROLOL TARTRATE tabs, 50 mg strength, PO/ORAL route, with BID schedule and a free-text instruction to consume the drug after meals would yield the following instructions: "METOPROLOL TARTRATE TAB 50 MG. TAKE ONE TABLET BY MOUTH TWICE A DAY AFTER MEALS."

The final steps involve verification by the provider and pharmacist. After reviewing the order elements, the provider clicks the "accept" button. This

causes the order to appear in the patient's list of medications, a different tab within the CPRS-GUI. The provider then electronically signs the order. The order appears in VISTA File 52.41, the Pending Prescriptions Menu. A pharmacist finishes the order by checking it for consistency. Prescriptions destined for mail-order delivery are dispatched to one of seven VA Consolidated Mail Outpatient Pharmacies (CMOPs). Otherwise the prescription is filled, labeled, and dispensed via the facility's pharmacy.

VA pharmacists are not required to follow every aspect of prescription orders. Within limits, a pharmacist may change the strength and quantity supplied of a medication. For example, an order for 150 tablets at 50 mg strength might be filled as 75 tablets at 100 mg strength. The pharmacist would then alter the dosing instructions as well to indicate splitting the scored tablet using a splitting device provided by the pharmacy.

The prescribing sequence for inpatient care is slightly different and depends on whether the order is intravenous (IV) or unit dose (UD). For an IV order, the provider can specify the solution (active or inert), the additive (medication), infusion rate, and priority. For a UD order, the provider specifies the dosage, route, schedule, comment, and priority. There is also a checkbox to indicate that an additional dose is to be given immediately upon receiving the order, rather than waiting until the next regularly scheduled time as indicated on the order form.

The CPRS-GUI is a dynamic system. Providers have access to a Quick Orders Tabs for inpatient and outpatient medications. They feature commonly used combinations of strengths, routes of administration, quantities supplied, and refills for the most common VA drug classes and other selected medications. If a provider chooses any of these combinations, the order dialog screen is automatically populated with most information required for the order; the provider need only specify changes such as pickup method (for outpatient prescriptions) and priority, and then accept and sign the order.

MAJOR PHARMACY DATA SOURCES

This section provides an overview of four VA electronic sources of pharmacy data. The first is VISTA, the integrated system of software and hardware of which the ordering system described above is one part. The three other sources obtain much of their data from VISTA. They include the Pharmacy Benefits Management (PBM) Version 3.0 database, the Decision Support System (DSS) National Data Extracts for inpatient and outpatient care, and the planned DSS National Pharmacy Extract.

VISTA

Much of the information in all electronic pharmacy datasets originates as data captured in VISTA. VISTA is the VA hospital information system, comprising a variety of software and integrated data systems written in Massachusetts General Hospital Utility Multi-Programming System (MUMPS® or “M”) (Hynes, Joseph, and Pfeil 2002).¹ VISTA consists of computer systems at each VA medical center and the national network that links them (Veterans Health Administration 2003). The nationally distributed VISTA software includes numerous “modules,” “applications,” and “packages” designed to store data on a particular subject and to produce management reports.

VISTA Pharmacy Data Files

The VISTA pharmacy package comprises 13 applications that gather, process, and store data pertaining to prescriptions and orders written and filled within the VA system (Veterans Health Administration 2003). Completed pharmacy transactions are stored in two locations in VISTA: the Prescription File (FILE 52) for outpatient prescriptions and the Pharmacy Patient File (FILE 55). FILE 55 has two subfiles, one for IV orders (FILE 55.01) and one for Unit Dose orders (FILE 55.06). Information specific to a particular prescription, such as start date and quantity dispensed, is stored in one of these files depending on the type of prescription.

In the prescription process, VISTA draws information from several files. The VA Product Name, National Drug Code (NDC), and price per dispensed unit come from the VISTA Local Drug File (FILE 50). Information regarding the provider is attached from the New Person File (FILE 200). As a result, each completed pharmacy transaction record contains significantly more information than what the physician entered via CPRS when ordering a prescription.

As discussed by Hynes, Joseph, and Pfeil (2002), VISTA is a patient care system, and data generally must be exported from VISTA to another environment to enable research use. Because VISTA was developed using M (formerly MUMPS), programs written using M software are the primary means to create extracts from VISTA packages. This can be a labor-intensive process involving development and validation of computer programs and the resulting data extract. Due to differences in VISTA implementations across sites, it may be necessary to modify a program for use at multiple sites.

Most VA researchers instead make use of derived data sources that draw from VISTA. For pharmacy data, two key sources are the Pharmacy Benefits Management (PBM) database and the National Data Extracts (NDEs) for inpatient and outpatient care produced from the VA Decision Support System

(DSS). When available, the planned DSS National Pharmacy Extract will be another important source. The DSS National Pharmacy Extract and PBM database extract information from VISTA and keep it at the level of individual prescriptions. The DSS NDEs for inpatient and outpatient care extract VISTA data and roll it up to the level of encounters. Each of the sources adds additional fields not found in VISTA.

PHARMACY BENEFITS MANAGEMENT (PBM) DATABASE

The Pharmacy Benefits Management Strategic Healthcare Group (PBM/SHG) is a VA entity responsible for managing the national VA drug formulary process. It carries out a broad range of activities related to pharmacy purchasing, clinical guidelines, and outcomes research (Ogden et al. 1997). To facilitate its work, PBM/SHG has developed software systems and databases to organize and analyze drug data. PBM data files are created and stored by the PBM/SHG at the Edward Hines Jr. VA Hospital in Hines, IL.

Every month, 128 VISTA systems representing every VA facility run the PBM V3.0 software to create a specialized data extract. The individual extracts are transmitted to PBM/SHG, which combines them, cleans and validates the data, creates additional elements, and stores them in an Microsoft® SQL® database. These data are made available to researchers as a flat file in Microsoft Visual FoxPro®, Microsoft Access®, or SAS® format.² The PBM database covers all pharmacy transactions (medications and supplies) from October 1, 1998, until about 60 days prior to a given date. The database is at the level of individual prescriptions, and thus a person can have multiple records on a given day. Although both inpatient and outpatient data are extracted, only the outpatient PBM data files are currently viable for research. This article, therefore, focuses on the outpatient data in the PBM database.

DSS NATIONAL DATA EXTRACTS FOR INPATIENT AND OUTPATIENT CARE

DSS is an automated management information system that tracks health care workload (i.e., utilization) and assigns an approximate cost to it. Each VA facility has a separate implementation of DSS, referred to as a DSS production database. The DSS production databases are standardized in structure and calculate the same cost and utilization figures. Although there is some variation across sites in the way costs are assigned to procedures (e.g., cardiac catheterization), pharmacy data appear to be treated uniformly. DSS NDEs for inpatient and outpatient care are SAS datasets created from the DSS production databases, as will be the planned DSS National Pharmacy Extract.

The DSS NDEs for inpatient and outpatient care contain summary utilization and costs data at the level of inpatient stay or outpatient health care encounter. The DSS inpatient data reside in two datasets: the DSS Discharge NDE, with data organized by inpatient stay (from admission to discharge), and the DSS Treating Specialty NDE, with data organized by inpatient provider specialty. There may be multiple records pertaining to a single inpatient stay in the Treating Specialty NDE. In the Outpatient NDE, a record represents a single interaction between a provider and a patient in an outpatient setting. Roughly one-third of DSS outpatient encounters represent a patient picking up a prescription at a VA pharmacy or a VA mail-order pharmacy filling and shipping an order. A person may have multiple records in the DSS Outpatient NDE dataset for a single day, though this is less likely than in the prescription-level PBM database.

DSS assigns both direct and indirect costs to inpatient and outpatient services, including pharmacy services. One element of the direct cost of a pharmacy service is VA's purchase price for the medication dispensed. Other direct and indirect (overhead) costs are assigned based on workload of the pharmacy department and costs assigned to the department in the VA general ledger. In the encounter-level inpatient and outpatient NDEs, it is not possible to attribute costs to specific inpatient prescriptions or other pharmacy services.

DSS NATIONAL PHARMACY EXTRACT

A third NDE pertaining to pharmacy data is in development. To avoid confusion with the main inpatient and outpatient NDEs, we will refer to it as the DSS National Pharmacy Extract. Each record will represent a single pharmacy product (prescription, supply, or other), and so there may be multiple records for a patient on a given day. A limited set of clinical and cost variables will be available as well, as detailed below.

ACCESS REQUIREMENTS

Access to VISTA systems is granted by the Information Resource Management (IRM) office at each facility. Separate institutional review board (IRB) approval for research use of the data is necessary at each facility as well.

For PBM data, researchers have access only to special-use data extracts created by the PBM/SHG field office at Hines VA Hospital. Requests for PBM data are fulfilled if the PBM/SHG confirms the following: the proposed data use will not conflict with PBM/SHG's primary mission of managing the VA formulary process; IRB approval has been granted; all applicable laws, regulations, and VA policies are being followed, including those pertaining to data

confidentiality and human rights; and the requestors have completed a use and nondisclosure agreement.³ Non-VA researchers are provided PBM data by the PBM/SHG only if they are collaborating with a VA employee or belong to an official oversight body.

PBM/SHG will not release data for research if the design appears to favor a particular medication or class of medications or if the study is not scientifically valid. An example of a study for which the data request was rejected is a comparison of a branded drug to placebo without comparison also to a second standard medication for the same condition. Another example of a study denied PBM data is a project designed from a commercial perspective to measure the market share of a branded drug within the VA system.⁴

In some cases, there will be a charge for PBM data. VA employees may access the data for management purposes at no charge. Often there is no charge to create an extract for pilot VA research projects. For funded research, the PBM/SHG staff will request payment in proportion to the staff time needed to consult on protocol design and to compile, analyze, and report the data. In the case of simple data extracts that do not require protocol design assistance, there is only a nominal charge to cover programmer time.

The DSS NDEs for inpatient and outpatient care are stored in Austin, TX, at the VA Austin Automation Center. Access requires a timeshare account and specific dataset authorization from the VA Automated Customer Registration System (ACRS). An ACRS Point of Contact at the local facility handles most requests. This person often is the facility's Information Security Officer. Authorization also requires completion of a DSS data nondisclosure agreement. Non-VA users must obtain additional approvals. See the VIREC Web site for additional information and assistance.⁵ Access to the planned DSS National Pharmacy Extract is expected to be similar.

Although the DSS production databases contain real social security numbers (SSNs), the DSS NDE inpatient and outpatient datasets feature only a scrambled SSN. Researchers requesting authorization to use the DSS NDE datasets can specify access to files with real or scrambled SSNs. A signed Privacy Act statement will be required from researchers requesting DSS NDE datasets with real SSNs.

Table 1 summarizes characteristics of the three VA pharmacy data sources with respect to structure, coverage, and access.

DATA ELEMENTS

In this section, we focus on selected data elements and which VA pharmacy data sources include them. Table 2 shows selected data elements of VISTA, the PBM database, and the DSS datasets arranged in categories corresponding to

(text continues on p. 106S)

TABLE 1 Structure and Access of Four VA Pharmacy Data Sources

		DSS			
		PBM Outpatient Database	National Pharmacy Extract (planned)	In/Outpatient National Data Extracts	VISTA
Structure and Coverage	Record level				
	Data format				
	Coverage	prescription several ^a all sites	prescription SAS [®] dataset all sites	encounter SAS [®] dataset all sites	prescription raw text one site ^b
	Multiple prescriptions in one record	✓	✓	✓ ^c	✓
Access	Includes outpatient prescriptions			✓	✓
	Includes inpatient prescriptions			✓	✓
	Location ^d	PBM/SHG	AAC	AAC	IRM
	Method of access	request	SAS [®] program	SAS [®] program	M program
	Separate IRB approval for each site				✓
	Separate IRM approval for each site				✓
	Protocol approval required	✓			
	Fee-based consulting available	✓			

a. Options include SAS[®] and Microsoft Access[®] or Visual FoxPro[®].

b. A Veterans Health Information Systems and Technology Architecture (VISTA) extract pertains only to the VA medical center (VAMC) that created it. There may be several VA facilities within a single VAMC.

c. The Decision Support System National Data Extract (DSS NDE) record reflects all pharmacy activity during an encounter, which could include multiple prescriptions.

d. PBM/SHG = Pharmacy Benefits Management Strategic Healthcare Group (Hines, IL); AAC = VA Austin Automation Center, accessed through a time-share account; IRM = the VA Institution Resources Management office at each VA medical center.

TABLE 2 Data Elements of the PBM Database, Planned DSS National Pharmacy Extract, Inpatient/Outpatient DSS National Data Extracts, and VISTA

	<i>Variable Description</i>	<i>DSS</i>			<i>VISTA</i>
		<i>PBM Outpatient Database</i>	<i>National Pharmacy Extract (planned)</i>	<i>In/Outpatient National Data Extracts</i>	
Medication	National Drug Code (NDC)	✓	✓		✓
	Station product name or description	✓			✓
	VA product name	✓	✓		✓
	VA drug class	✓			✓
	Regional (VISN) formulary indicator ^a	✓			✓
	National formulary indicator				✓
Dispensing Details	National formulary restrictions	✓			✓
	Fill date	✓	✓	✓	✓
	Prescription number	✓			✓
	Total quantity dispensed	✓	✓		✓
	Dispensing unit (mg, ml, etc.)	✓			✓
	Dosing instructions	✓			✓
	Days supplied	✓		^b	✓
	New fill/ refill/ partial indicator	✓		^b	✓
	Mail or window pickup indicator	✓		^b	✓
	Medication counseling acceptance indicator	✓			✓
Cost	Purchase price (from cost schedule)	✓			✓
	Purchase price per dispensed unit	✓			✓

	DSS fixed direct cost			✓ ^c	
	DSS variable direct cost			✓ ^c	
	DSS indirect cost			✓ ^c	
	DSS total cost		✓	✓ ^c	
	DSS average dispensing cost		✓		
	DSS variable supply cost			✓ ^c	
Clinical Data— Outpatient	Clinic code	— ^d	✓	✓	✓
	DSS department number		✓	✓	
	Diagnosis codes	— ^e	— ^e	— ^e	✓
	Procedure codes (CPT)	— ^d	— ^f	— ^e	✓
Clinical Data— Inpatient	Laboratory & radiology tests		— ^f	— ^f	✓
	Admission date		✓	✓	✓
	Discharge date		✓	✓	✓
	Treating specialty		✓	✓	✓
	Bedsection (ward)		✓	✓	✓
	Diagnosis codes		✓ ^e	✓ ^f	✓
	Admitting DRG			✓	✓
	Discharge DRG			✓	✓
	Procedure codes (CPT)			✓	✓
	Laboratory and radiology tests			— ^g	✓
Patient Demographics	True social security number (SSN)	✓	✓	✓	✓
	Scrambled SSN		✓	✓	✓
	Date of birth		✓	✓	✓
	Age		✓	✓	✓
	Gender		✓	✓	✓
	Low-income identifier (means test) ^h		✓	✓	✓

(continued)

TABLE 2 (continued)

	Variable Description	PBM Outpatient Database	DSS National Pharmacy Extract (planned)	DSS In/Outpatient National Data Extracts	VISTA
Physician/ Provider	Zip code		✓		✓
	Provider ID ^d			✓	✓
	Provider type	✓		✓	✓
	Provider class	✓			✓
	Provider service/section	✓			✓
	Provider specialty and subspecialty	✓			✓
	Primary care team		✓		✓
	Primary care provider ID		✓	✓	✓
	Primary care provider type			✓	✓
Pharmacy	Associate primary care provider ID		✓	✓	✓
	Associate primary care provider type			✓	✓
	Station number (facility ID)	✓	✓	✓	✓
	VA regional network (VISN)			✓	✓
	Consolidated Mail Outpatient				
	Pharmacy (CMOP) indicator	✓	✓		✓

a. VISN = Veterans Integrated Service Network, a regional network of VA facilities.

b. Planned fields not yet available.

c. Reflects all pharmacy transactions during an encounter.

d. Pharmacy Benefits Management (PBM) data could be matched to the standard outpatient utilization file, but a particular prescription could not be attributed to a particular clinic stop, procedure, or diagnosis, if more than one appeared on the outpatient record for that day.

e. Primary diagnosis or procedure only. Others available by linking to standard VA utilization files.

- f. Separate Decision Support System (DSS) extracts record laboratory and radiology / nuclear medicine tests. An extract containing laboratory test results is under preparation.
- g. Treating specialty diagnosis code for the bedsection segment during which the pharmacy order occurred.
- h. The cost of some VA services will depend on the patient's service connection (0%-100% or none) and household income.
- i. The provider ID is the provider's SSN in the PBM data, and the NPCD provider ID in the DSS NDE and Pharmacy Extract. The NPCD provider ID allows the provider to be tracked in the standard VA health care utilization files.

characteristics of the medication, dispensing details, cost, clinical data, characteristics of the patient and the provider, and the pharmacy. VISTA contains a very large number of data elements, including several pharmacy-related management modules. We will show only those VISTA elements that appear in the PBM or DSS pharmacy databases. A listing and brief description of VISTA modules appears in the VISTA Monograph (Veterans Health Administration 2003).

MEDICATION AND DISPENSING DETAILS

The PBM database contains the most information on the prescribed medication. Variables include the National Drug Code (NDC), locally assigned drug name (station product name), uniform drug name (VA product name),⁶ national formulary indicator, VISN (Veterans Integrated Service Network) formulary indicator, and other indicators not shown in Table 2. Two formulary indicators appear because VA medical centers may have medications on their formularies that do not appear on the national VA formulary. The DSS NDEs have no information on particular medications, because they are summary-level data at the inpatient stay or outpatient encounter level, and hence a single record may reflect multiple prescriptions.

The PBM database and VISTA are also the best sources of information on dispensing details. Basic elements include the prescription fill date, total quantity dispensed, dispensing unit, and days supplied. Additional VA administrative elements include the indicator for new, refill or partial refill prescription, the mode of pickup, and whether the patient was offered and accepted counseling.

A very unusual feature of PBM and VISTA is the availability of dosing instructions. The wording of dosing instructions has not been standardized, however, and many are written with medical abbreviations, such as "T2T QID PRN" and "APPLY EXT TAA BID UD." Working with dosing instructions as research data is painstaking but yields information available from no other source. Research uses include studies of patient or caregiver adherence to physician instructions and the relation between physician intentions (as expressed in the dosing instructions) and the actual medication forms dispensed by the pharmacist. To identify cumulative exposure to inhaled corticosteroids in a cohort of patients with chronic obstructive pulmonary disease, VA researchers are using the dosing instructions field in VISTA to identify the number of doses prescribed and the frequency of administration. They are combining this information with the dose of the medication dispensed to estimate the total dose of inhaled corticosteroids consumed over a defined time period.⁷

The DSS National Pharmacy Extract contains two dispensing details at present, the fill date and the total quantity dispensed. Additional elements planned for future updates include days supplied, new fill/refill indicator, and pickup indicator. The DSS NDEs for discharge, treating specialty, and outpatient data provide only the date of the inpatient stay or outpatient encounter that included pharmacy service. That is, they record whether or not pharmacy costs were assigned to the particular stay or encounter, but not details of the pharmacy services provided.

COST DATA—SOURCES

Several elements contribute to the recorded price of a prescription. VISTA pharmacy modules have three key variables: (1) the price per dispensed unit from FILE 50; (2) the quantity dispensed from the VISTA Pharmacy package; and (3) the total cost, defined as the product of the first two.

A single NDC has up to five purchase prices (acquisition costs) associated with it. Three are federal-wide, and two are VA-specific. The federal-wide costs come from the Federal Supply Schedule (FSS), the FSS Tier schedule, and the federal ceiling price (FCP, or “Big 4”) schedule available to VA, the Department of Defense, the Coast Guard, and the Public Health Services (U.S. General Accounting Office 2000). The two prices specific to VA come from the agency’s National Contracts and Blanket Purchase Agreements (BPAs). About 3 percent of VA medication expenditures occur at market prices, outside of a PBM national contract or federal schedule. Costs for noncontract medications will vary by facility and by purchase date.

The cost associated with an NDC usually varies across schedules. On one day in September 2002, for example, a package of five insulin lispro 100 (Humalog[®]) pens ranged from \$51 to \$61 on the FSS, FSS Tier, and FCP schedules; a package of 1,000 olanzapine (Zyprexa[®]) 20 mg tablets cost roughly \$13,000 on the FSS and \$10,800 on the FCP.⁸

Changes in drug costs are recorded in VISTA FILE 50 following manual updates from the VISTA Drug Accountability Package (DAP). The updates are not automatically reflected in a facility’s VISTA system, however. A local pharmacy employee must run the DAP software to obtain the most recent prices. Contract changes occur year-round, and so the cost schedules change on nearly a daily basis. Due to staffing limitations, local DAPs generally are not updated daily (Cunningham, Sales, and Valentino 2001). The cost assigned to a prescription in a local VISTA system, therefore, may not reflect the most current price. The overall effect of such errors in drug prices is unclear because costs can rise or fall as contracts are renegotiated.

Using the NDC field, one can link PBM data to other databases to find commercial costs such as average wholesale price (AWP), maximum allowable cost (MAC), or wholesale acquisition cost (WAC). To estimate VA drug expenditures, use only official VA drug costs (available on the PBM Web site, www.vapbm.org). Substantial errors can arise if AWP or other commercial costs are employed. For example, the 1998 VA cost for an annual supply of the cholesterol medication gemfibrozil (\$46.75) was less than one-twentieth of the AWP for the same agent, Lopid (\$956.96) (Nyman et al. 2002). AWP and other commercial costs may be useful, however, for simulating the cost of an intervention outside the VA.

COST DATA—VARIABLES

VISTA and PBM feature the purchase (schedule) price of the dispensed medication, as just described. DSS sources do not contain the schedule price but nevertheless provide a wealth of information on direct and indirect costs.⁹ Direct costs are those specifically related to patient care, such as salaries and the purchase price of medications. The fixed direct cost does not vary with the volume of services. The variable direct cost consists of items that vary with the volume of services, including the acquisition cost of the medication or supplies dispensed. Indirect costs represent expenditures that cannot be tied to specific services, such as property acquisition and maintenance.¹⁰ The sum of fixed direct, variable direct, and indirect costs is the total cost.

The DSS NDEs for inpatient and outpatient care feature an average dispensing cost for the facility. This average cost will vary across fiscal years and facilities. Actual dispensing cost would be difficult to measure, as it would depend on where the order was filled (local pharmacy or CMOP), type of medication or supply, staffing cost, and other factors.

Variable supply cost is an estimate of the cost of all supplies used by the pharmacy for the patient on a given day. It is calculated as the variable direct cost multiplied by an adjustment factor. (See Yu and Barnett [2002a] for details of its calculation.) The adjustment factor is fixed for all outpatient pharmacy records for a particular medical center in a fiscal year. The adjustment factor is based on an assumption that the variable nonsupply cost of each record is proportionate to the supply cost.

CLINICAL DATA

Researchers often wish to link prescriptions to clinical data. A study of adherence to clinical practice guidelines for heart disease, for example, would require a linked dataset containing information on prescription drugs,

inpatient and outpatient services, diagnoses, and procedures. The data sources in Table 2 either contain nonprescription data elements or can be merged with such data from other VA sources.

It is not surprising that VISTA is the best source of clinical data, since one of its functions is to support CPRS, the means by which providers and other VA staff create a patient's electronic medical record. The usefulness of VISTA for research, however, is limited by the inconvenience of performing separate extractions at each VA medical center.

More convenient are the DSS NDEs for inpatient and outpatient care. These contain the clinic code, which identifies outpatient clinics, and the DSS-specific department number, a second way to track the location of care. They also feature the primary diagnosis code, if any, associated with the outpatient visit. The NDEs for inpatient and outpatient care list primary procedure as well. Any additional diagnosis and procedure codes may be found by linking to the Medical SAS Datasets of inpatient and outpatient care.

Other pharmacy data sources have less clinical information. The DSS National Pharmacy Extract features the primary diagnosis code but no procedure codes. The PBM database contains no information on patient clinical characteristics. Both sources can be linked to Medical SAS utilization data using the date, location, and patient SSN. Such linkage does not make it possible, however, to attribute a prescription to a particular clinic code or diagnosis, if more than one appeared on the outpatient record for a given day.

Many researchers would find it useful to link prescription data to laboratory and radiology test results. DSS NDEs for laboratory and radiology tests were recently developed. They do not contain results, but simply record the fact that a test occurred. The files may be linked to other data sources by patient ID and date. The DSS Program Office is developing a new NDE that will feature laboratory test results. A similar process is under way for PBM.

Inpatient clinical data are available in VISTA, the planned DSS National Pharmacy Extract, and the DSS NDE for inpatient care. All three sources contain the admission and discharge dates, the treating specialty, and bedsection (ward). VISTA contains all diagnosis and procedure codes associated with a given inpatient stay, but the DSS NDEs for inpatient care have only the primary diagnosis code and no procedure codes. Similarly, the planned DSS National Pharmacy Extract will feature only the diagnosis code for the treating specialty during which the prescription order occurred. Additional diagnosis and procedure codes could be obtained by linking the DSS sources to the Medical SAS Datasets for inpatient care. The overlap between the Medical SAS Datasets and the DSS inpatient and outpatient NDEs is not perfect, however (Yu and Barnett 2002a, 2002b).

PATIENT DEMOGRAPHICS

Researchers may want to stratify prescription drug use by patient characteristics, such as for studies of racial and ethnic differences in treatment patterns or outcomes. VISTA contains all such information collected by VA providers and staff, including many more items than are listed in Table 2. For example, through VISTA one can learn the patient's disability status, service connection (0%-100% or none), and military service details such as dates, places, and branch of service. Medical information such as height and weight may be found in the VISTA Vitals/Measurements package.

PBM and the DSS sources vary considerably in their coverage of demographic information. The PBM outpatient database contains only the patient SSN, although one can use it to link to demographic data in other sources. An updated PBM database now under development will include additional demographic and clinical data. The DSS NDEs for inpatient and outpatient care contain SSN, date of birth, age, and gender. The planned DSS National Pharmacy Extract will contain a wealth of data on patient characteristics. In addition to the patient ID (SSN), it will feature gender, date of birth, low-income status (based on the local threshold for federally subsidized low-income housing), and home zip code.

PROVIDERS/PHYSICIANS

A number of studies have tested the hypothesis that provider characteristics affect prescribing patterns, including Mark et al. (2002) and Newton et al. (2001). Such research is possible with VA pharmacy data sources, which offer an array of data fields pertaining to prescribing physicians and primary care providers.

VISTA is once again the richest source of information. It features data on the prescribing physician and the patient's primary care team. Variables include the provider ID, an indicator of VA affiliation, provider type, class, service or section, and medical specialty and subspecialty. The provider ID is a created number unique to the VA facility. Provider type indicates the physician's status as a VA staff member or a non-VA Fee Basis provider (see Other Sources, below). The class is the physician's degree type, such as MD or DDS. Examples of VA services and sections are psychiatry, surgery, and medicine. The specialty refers to the provider's medical specialty, such as internal medicine or oncology.

The other data sources provide somewhat less detail on providers. The PBM database is strongest for provider information but contains no details on primary care providers. The DSS NDEs for inpatient and outpatient care

provide considerable detail on primary care providers but little information about the prescribing physician, and the planned DSS National Pharmacy Extract will do so as well.

PHARMACY CHARACTERISTICS

Each of the data sources offers some information on the pharmacy that provided the prescription. Each identifies the facility ID, or station number, that references the VA medical center. VISTA and the DSS NDEs for inpatient and outpatient care further identify which of 21 regional networks, or VISNs (Veterans Integrated Service Networks), it belongs to. Tens of thousands of VA prescriptions every day are filled by CMOPs, the VA regional automated pharmacies. The DSS outpatient NDEs and VISTA identify whether a CMOP was the source of a prescription. The same information may be obtained in PBM through the pickup indicator: a value corresponding to mail delivery indicates that a CMOP filled the order. A similar indicator is planned for the DSS National Pharmacy Extract.

OTHER SOURCES

DSS PRODUCTION DATA

The DSS production databases at VA medical centers contain prescription-level records. They can be used to generate clinical and cost reports of medical center pharmacy and other services, although generally they are not directly accessible by researchers. DSS reports can be requested from local DSS staff, but researchers may be charged for computing costs. The DSS National Pharmacy Extract currently under development will feature detailed prescription level data and, thus, will make it less likely that researchers will need to obtain data from the local DSS databases.

FEE BASIS FILES

When VA facilities cannot provide needed care or when a non-VA facility can provide care more economically, the VA may pay for care at a non-VA facility. These services fall under the Fee Basis Program, which covers inpatient care and outpatient medical and dental care. Pharmacy services are part of the Fee Basis program. Fee Basis pharmacy payments totaled \$765,000 in FY1998, including \$282,000 for reimbursement to veterans and \$483,000 for direct payments to pharmacies. Although this represents a small fraction of total VA

pharmaceutical spending, which totaled over \$1.5 billion in FY1999, the Fee Basis files complete the picture of VA pharmacy services.

The Fee Basis data are maintained in seven files pertaining to inpatient hospital stays, inpatient ancillary services, outpatient services (other than pharmacy services), pharmacy services, travel expenses, and two for miscellaneous payments (to other vendors and to Fee Basis ID card holders). A separate set of files is created for each fiscal year.

The Fee Basis Payments to Pharmacies file contains a record of each outpatient prescription from a non-VA pharmacy paid under the Fee Basis program. Data elements include the fill date, amount claimed, and amount paid, but not drug-specific characteristics such as NDC, drug name, or days supplied. Using the patient's scrambled SSN, the Fee Basis pharmacy file can be linked to other Fee Basis files and to national utilization data in the Medical SAS Datasets. Thus, total outpatient prescription drug costs can be determined, although costs cannot be ascribed to particular medications. Fee Basis inpatient pharmacy costs cannot be separated from other inpatient costs.

VA will pay for prescriptions from community pharmacies only when the medication is for treatment of service-connected conditions. Veterans who obtain prescriptions from non-VA pharmacies without prior arrangement will be reimbursed only if the prescribing non-VA physician deems them necessary for treatment of authorized conditions and the situation is urgent or emergent. Reimbursement is limited to the amount sufficient to purchase a 10-day supply of the medication. In all cases, the VA payment will be a function of the medication's average wholesale price plus the state-specific Medicaid dispensing fee.

The Fee Basis files will be useful either as an adjunct to other sources or for studies of the Fee Basis program itself. Patients whose non-VA care appears in the Fee Basis files will also appear in other VA databases if they receive care at VA facilities. Users should also note that the VA is planning to alter or replace the system so that Fee Basis transactions will be recorded in DSS. The date of the transition is unknown at this time.

PHARMACY COPAYMENTS

VA charges a copayment for outpatient prescriptions when the supply lasts 30 days or less and the medication is not for a service-connected condition. In calendar year 2002, the patient's copayment was \$7 per prescription. Certain veterans are exempt from copayment, such as those with service-connected disabilities rated 50 percent or greater, and those with income below the VA pension level (U.S. Department of Veterans Affairs 2002).

The pharmacy data sources described in this article do not explicitly record prescription copayments. The pharmacy costs they report are from VA's perspective rather than the patient's. Categorical exemption from copayment can be determined from electronic data sources, however. Low-income status is indicated by a means-test variable in VISTA and the planned DSS National Pharmacy Extract. Both the means-test indicator and percent service connection are available in the standard inpatient and outpatient utilization files, the Medical SAS Datasets. Information on those datasets is available on the VIREC Web site.⁵

DATA QUALITY

MISSING DATA AND CONSISTENCY CHECKS

VA pharmacy data will inevitably contain some missing or erroneous values. We strongly recommend producing frequency distributions and descriptive statistics before using pharmacy data for analyses. This approach will identify, for example, NDCs beginning with 00000 or 99999, values for days supplied and quantity supplied that are not integers greater than 0, and unit or total cost \leq \$0. Records with these values should not be discarded without investigation; it may be possible to rectify an obvious error using other data on the record.

A potential hazard in using total quantity dispensed is the variation across facilities in the assignment of dispensed units. For example, a 50 ml injection may be recorded at one facility as 50 units and at another as one unit. In theory, the two may be reconciled based on other information on the record, such as the NDC or dosage instructions. One approach to locating such variations is to tabulate the range of dispensed units for selected NDCs.

Checking the validity of cost data may be complicated. One could in theory observe two prices for a single NDC on the same day simply because one facility had not updated its DAP. Likewise, blanket purchase agreements may cause a disparity in price between two facilities on the same day for the same product. Again, univariate statistics can alert researchers to outlying values. Substantial cost variation across facilities and across time within a single facility should be investigated. For many applications, replacing the facility's cost values with the end-of-year national value would be acceptable. In other applications, variance throughout the year reflects true variation that should be preserved.

Several options exist for handling erroneous or missing values in pharmacy data. Costs and dispensing unit (mg, ml, etc.) may be filled in through refer-

ence to other prescriptions for the same NDC. For cost it is preferable to use data from the same facility and about the same time. The NDC corresponds to a particular package size as well, thereby providing a potential alternative source for the number of units dispensed. In some cases, less than an entire package is dispensed, however. Checking for similar prescriptions for the same patient is advisable.

Although NDCs represent the most precise way to identify medications, the NDC listed on a VA record may not be the NDC from which the order was filled. If there are multiple manufacturers (as for generics), a single NDC in the VA record may be used to represent all similar combinations of product, strength, and dosage form from all manufacturers.

For branded medications, a single NDC in the VA record may represent all package sizes for the same combination of product and strength. For example, a single NDC is used for sildenafil citrate (Viagra®) 50 mg, although prescriptions for it may be dispensed from two different package sizes (30 or 100 tablets), each of which has a separate official NDC associated with it. The VA National Drug File lists every official NDC associated with each VA product name.

VALIDATION

A primary method for determining the quality of database information is to verify it against a standard known to be accurate. VISTA is the primary source of clinical data in VA. There is no written patient record against which to validate VISTA because providers enter information directly into the system. In theory, it could be compared to observational data, but we are aware of no such studies.

Some VISTA fields are allowed to vary across sites. The dispensed-units field, for instance, is created by each pharmacy without the benefit of unifying national guidelines. The problem is most often for topicals, liquids, and aerosols, although even for these products, mail-order prescriptions generally have reliable data.

We are not aware of studies validating DSS national extracts against VISTA, but the DSS system appears to capture utilization well. Yu and Barnett (2002a, 2002b) compared the DSS discharge, treating specialty, and outpatient NDEs to the Medical SAS Datasets of inpatient and outpatient utilization. The count of inpatient visits was very similar in the two sources. Outpatient non-pharmacy visits diverged by several percentage points. Outpatient pharmacy records could not be directly compared due to differences in the method of counting visits: the DSS system includes pharmacy visits even if the patient

did not see a provider, whereas the Medical SAS Datasets count only visits that involve a provider.

The outpatient NDE datasets include some services not reported in the VA Medical SAS Datasets for outpatient care, the primary source of VA outpatient care utilization data. These additional records represent events that cannot be tied to a specific visit, such as when a patient fills a prescription at a VA pharmacy but obtains no medical services on that date. Yu and Barnett (2002a) detailed how indicator variables may be used to identify records representing visits to the "pharmacy clinic."

The quality of DSS cost data is less known. Data quality is believed to be higher at VA facilities where implementation of the databases began earlier, and overall it is thought to be improving each year. Researchers interested in using DSS cost data from a single facility, particularly data from FY1999 or earlier, are advised to ask the local DSS managers and the VA DSS Program Office about data quality.

A number of evaluations have been carried out by the PBM/SHG field office and others in which PBM data were compared to separate data sources at individual facilities. In one, the PBM database was found to include at least 99 percent of all outpatient prescriptions.¹¹ As noted below, studies such as these represent an important area for future research.

Accurate interpretation of prescription records is improved by reference to the National Drug File, which was developed by PBM/SHG to match locally assigned drug names (station names) to agency-wide standard names (VA Product Names). The file contains other information as well, such as NDC, package type, strength, dispensed units, and VA drug class. The National Drug File, which is updated every 2 months, may be downloaded from the PBM/SHG intranet Web site.

DISCUSSION

The VA pharmacy data sources described here have great potential for use in health economics and health services research. The number of published studies employing these sources is small but growing rapidly. The range of subjects addressed is broad, encompassing prospective and retrospective studies of health outcomes, cost-effectiveness and other health economics analyses, quality of care studies, and health systems research. Studies also have illustrated the usefulness—and frequently the necessity—of combining data from multiple sources.

Many studies have extracted data directly from VISTA, usually in conjunction with other data. Keiser et al. (1999) studied the impact of a pharmaco-

therapy for HIV at a VA medical center. Prescriptions and other utilization data were drawn from the medical center Immunology Case Registry, a VISTA module. The authors determined average cost of care by combining the VISTA data, HIV-related workload from a department survey, and costs from the medical center's fiscal service. Weaver and colleagues extracted inpatient unit dose and intravenous antibiotic therapy from VISTA for patients with urinary tract infections.¹² By using the PBM database to track outpatient antibiotics and UTI-related medical supplies (catheters, as a measure of bladder management), the authors were able to determine the impact of antibiotic therapy and bladder management on type of UTI. Hynes, Joseph, and Pfeil (2002) list additional studies making use of data extracts from VISTA.

A number of studies have used PBM data, most focusing on mental health. Outcomes studied include the relationship of antipsychotic dosing to recommendations from the schizophrenia Patient Outcomes Research Team (PORT) (Leslie and Rosenheck 2001b), the link between second-generation (atypical) antipsychotics and the presence of diabetes mellitus (Sernyak et al. 2002), the connection between fiscal stress at the provider facility and the probability of receiving first-generation (typical) versus second-generation (atypical) antipsychotics (Leslie and Rosenheck 2001a), and how well medication adherence predicts the likelihood of inpatient admission (Valenstein et al. 2002).

Data from the DSS system have been used in only a few published studies. Barnett et al. (2002) employed the DSS NDE for inpatient care to estimate total spending among patients with myocardial infarction. Maciejewski et al. (2002) used the DSS NDEs for inpatient and outpatient care to find direct costs for primary care, including pharmacy. By using DSS, the authors were able to estimate direct costs separately from indirect costs. As they noted, the components of indirect cost varied by facility. An analysis that includes indirect costs should take account of the variability in accounting practices across VA facilities.

CHOOSING A SOURCE

Considerations when choosing a VA pharmacy data source include the data elements needed, the time and effort that can be spent obtaining the data, and the level of aggregation desired. Table 3 summarizes the content of the pharmacy data sources described above, listing the events covered, data format, record level (prescription vs. encounter), and advantages and disadvantages.

Researchers needing details of medications and prescriptions will need to use PBM or VISTA as their data source. Obtaining data from VISTA is significantly more difficult, and so, unless additional clinical data are needed, the PBM database will be the better choice. The trade-off between time and

TABLE 3 Summary of VA Pharmacy Data Sources

<i>Source</i>	<i>Events Covered</i>	<i>Data Format/Record Level</i>	<i>Advantages</i>	<i>Disadvantages</i>
VISTA	All health care utilization at one facility	ASCII/patient-level inpatient stay or outpatient event	Greatest detail of personal and utilization characteristics	Requires specialized programming, permission by each facility, and careful interpretation across facilities
PBM	All pharmacy products	several formats ¹ /product	All prescription characteristics, national coverage	Limited demographic and clinical information
DSS Inpatient/Outpatient NDEs	All health care utilization	SAS [®] /patient-level inpatient stay or outpatient event	National coverage, summary cost data	Limited prescription characteristics
DSS National Pharmacy Extract (planned)	All pharmacy products	SAS [®] /product	National coverage, cost at product level	Limited prescription characteristics

Note: PBM = Pharmacy Benefits Management; NDE = National Data Extract; VISTA = Veterans Health Information Systems and Technology Architecture; DSS = Decision Support System.

1. Options include SAS[®] and Microsoft Access[®] or Visual FoxPro[®].

money also may be a consideration. VISTA data are free but require special permissions and programs. PBM data are extracted by the PBM/SHG staff and so require relatively little effort, but funded studies will be charged for their assistance.

Another axis of choice pertains to characteristics of the cost data available. Only DSS estimates a total cost, including indirect costs and direct costs beyond the purchase prices of medications and supplies. Thus, researchers studying the total cost of VA pharmacy care (or of all VA care services) must rely on the DSS extracts or else must estimate the other cost factors by another means.¹³ Because they are estimates, the researcher must bear in mind that a different method of estimating costs, such as another way of allocating overhead to particular services, would yield somewhat different costs, particularly indirect costs.

The level of data aggregation to be used may guide the choice of data source. VISTA, PBM, and the DSS local databases can be used for prescription-level research, and these data may be aggregated into encounters with relative ease. The DSS NDEs for inpatient and outpatient care are already organized by encounter, and so all of these data sources are appropriate for studies of utilization at the encounter level and higher.

SYSTEMATIC LIMITATIONS OF VA DATA

Limitations in the PBM and DSS data can often be overcome by linking data from multiple sources. Clinical information such as treatments and diagnoses are available in the VA Medical SAS Datasets for inpatient and outpatient care. Yu and Barnett (2002a) described the method for linking these sources to the DSS NDEs for inpatient and outpatient care. The lack of detailed information on characteristics of individual prescriptions can be overcome either by supplementing the NDEs with an extract from the local DSS production data system or by sending the PBM staff the study individuals' encrypted SSNs and obtaining an extract from the PBM database.

VA data inevitably reflect VA practice patterns. This is clearest in the cost fields, which are frequently specific to individual VA facilities. A more subtle connection concerns the mix of therapies used to treat specific illnesses. For example, a capitation-based funding system coupled with substantial negotiated discounts on antidepressant medications could lead VA providers to favor medications over office-based psychotherapy, all else equal. If so, then extrapolating antidepressant prescribing patterns to non-VA providers that do not enjoy the same level of discounts could overstate the likely cost of antidepressants for those providers.

The time and effort needed to obtain permission to access the data sources described earlier will not be trivial, especially for non-VA researchers. Moreover, the sources are frequently revised to add, drop, or modify data elements. To avoid the cost of changing sources midstream, it is advisable to obtain current listings of data elements before choosing one for a research project. VIREC has placed information materials on its Web site pertaining to DSS, the PBM database, and other VA utilization files.⁵ Specific questions about PBM data may be addressed to the PBM/SHG staff.³ The Fee Basis files are described in the *Fee Basis Guidebook*, available from the VA Health Economics Resource Center (HERC).¹³

A final issue concerns patients' dual use of VA and non-VA systems. The VA's relatively generous pharmacy benefits are known to attract users who wish to supplement their Medicare coverage. More than 50 percent of VA enrollees have Medicare coverage, including 22 percent of those under age 65 (Shen et al. 2003). As a result, one cannot rely on VA sources alone to present the entire picture of health care services for VA patients. One option is to limit analyses to the realm of VA health care. VA is of interest due to its large patient population, nationwide representation, and federal funding, and many studies focus on VA services for these reasons. Another option is to obtain Medicare records for VA patients, linking them to VA encounter data through SSNs.¹⁴ This provides a more complete picture of health services and enables research on movement between alternative systems of care.

AREAS FOR FUTURE RESEARCH

Reports of successes and difficulties in using the VA pharmacy data for typical health services research, such as outcomes studies, would benefit future investigations. Data quality is an important area for research, particularly due to the recent and ongoing development of these pharmacy data sources. The usefulness of VA pharmacy data sources would be improved by research on data quality and comparative studies of alternative pharmacy data sources.

Potential research topics include comparisons of DSS and PBM extracts to a benchmark data source; analyses of changes in data quality over time; explanations of changes in the range and construction of data elements, particularly those pertaining to costs, medication identifiers, and prescription characteristics; comparisons of data quality across types of medication and across facilities; and studies of data quality for nonprescription pharmacy supplies, both generic medications and nonmedication supplies.

A natural question is what to use as the standard of comparison. Although direct measurement of pharmacy data is possible in theory, it would likely be less accurate than VISTA. A pharmacy survey completed by patients would be

subject to the limitations of cognitive ability and poor recall. And there are too many pharmacies and too many prescriptions to make direct observation of pharmacy transactions a realistic method. For these reasons, VISTA must stand as the most reliable source of pharmacy data.

As noted earlier, prescription cost data for PBM comes from the Drug Accountability Package (DAP) in VISTA. Although updates to contract prices occur nearly every day, in practice, VA pharmacists report that they update their local DAP less frequently, sometimes no more than monthly. An important area for research is the extent to which drug costs in VISTA (and hence the PBM and DSS databases) are misreported as a result.

Many researchers will want to link pharmacy data to other utilization data, to patient demographics and clinical characteristics, to administrative data on facilities, and perhaps to other data types as well. As health services research using linked pharmacy data is carried out, it would aid the research community if authors would report their experiences in matching records across data sources. Yu and Barnett (2002a, 2002b) provided examples of this type of study. Outcomes of interest include the proportion of people and the proportion of records that can be linked, what difficulties were found in linking (such as missing values or differences in database formats), and how such difficulties were overcome or avoided.

NOTES

1. MUMPS is a registered trademark of the Massachusetts General Hospital Corporation.
2. Microsoft, SQL, Access, and Visual FoxPro are registered trademarks of Microsoft Corporation in the United States and/or other countries. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.
3. See the PBM Web site at www.vapbm.org for information on contacting the PBM/SHG and completing a PBM Data Request Form.
4. Personal communication from Michael Valentino, PBM/SHG.
5. The VIREC Web site address is www.virec.research.med.va.gov. The VIREC help desk e-mail address is virec@research.hines.med.va.gov.
6. The VA product name is unique if there is a single supplier, as for branded medications. If there are two or more suppliers, a single VA product name may apply to all.
7. Personal communication from Todd Lee, Midwest Center for Health Service and Policy Research, Edward Hines Jr. VA Hospital, Hines, IL.
8. From price schedules on the PBM/SHG Web site.
9. Researchers interested in the cost of VA pharmacy will want to use only the September DSS files. Cost figures for the fiscal year are finalized in the September files. And

because the DSS files are cumulative within each fiscal year, only the September files provide information spanning an entire year.

10. The DSS system allocates indirect costs according to a several-step procedure. See Barnett and Rodgers (1999) for an overview and chapter 3 of Yu and Barnett (2002a) for details.
11. Personal communication from Francesca Cunningham.
12. F. M. Weaver, C. T. Evans, G. J. Joseph, J. P. Parada, J. S. Wheeler, S. Sabharwal, B. Nemchausky. "Management of frequent urinary tract infection in veterans with spinal cord injuries and disorders." Manuscript under review.
13. See the HERC (Health Economics Resource Center) Web site at www.herc.research.med.va.gov; herc@med.va.gov.
14. Under a Memorandum of Understanding between Health and Human Services and the Department of Veterans Affairs, VIREC is preparing linked files of VA and Medicare data beginning with 1999. Announcement of the availability of datasets with merged VA-Medicare data is expected during the fourth quarter of FY2003. For information, contact VIREC at virec@research.hines.med.va.gov.

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